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DDC 10 YEAR REQUIREMENTS AND PLANNING STUDY

Literature Survey Report

AUERBACH ASSOCIATES INC.
121 North Broad St.
Philadelphia, Pa. 19107

17 October 1975

Progress Report

Approved for Public Release; Distribution Unlimited

Prepared for

DEFENSE DOCUMENTATION CENTER
Cameron Station
Alexandria, Va. 22314

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DIN 10 Year Requirements and Planning Study
LITERATURE SURVEY REPORT

ALSR-2313/2126-TR-2

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DSA 900-75-C-5511

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Management Planning
Management Requirements
Technical Information
Information Retrieval Systems
Information Transfer
Bibliographies

Literature was reviewed from some 68 sources that indicated trends in advancement of technology for scientific and technical information for application to DDC's technical objectives for the 1978-1988 period. Events gleaned from the literature are intended for review by expert panels in information transfer to determine their desirability, feasibility, and probable timing. Findings are summarized in four categories: Technology.

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Organizational Structures and Applications, Economics and Market..., and Scope of Services.

An events list was developed with 41 projected events in information transfer considered by the project team to most likely affect the Defense community in 1978-1988.

A bibliography of the 68 information sources is presented as an appendix.

TECHNICAL NOTE
AUER-2325/2326-TN-2

LITERATURE SURVEY REPORT

October 17, 1975

Prepared by
Martha Morrow and Jerome T. Maddock

Submitted to:

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TABLE OF CONTENTS

SECTION I. INTRODUCTION

1.1 PURPOSE OF THE LITERATURE SURVEY

The literature survey described in this report is an integral part of the survey of potential sources of advanced technology for 1978-1988 application to DDL's technical objectives for that period. It is designed to provide background on the current state of the art of information storage and transfer and the future trends in information storage and transfer in the years 1978-1988, likely to impact on the defense community. Events gleaned from the literature reviewed here will be presented to experts in information transfer in order to determine their desirability, feasibility, and probable timing

1.2 SUMMARY OF FINDINGS

The literature survey covered some 68 sources. Highlights of the findings are presented below. A more complete discussion of these findings is contained in Section III.

- Technology

  The following will be in common use in [illegible]

  - Computers designed for specific applications
  - Much larger, cheaper, and faster computer memories
  - Mini-computer networks
  - Cheap and easily accessed data transmission
  - Machine-independent software
  - Self-monitoring systems
  - New applications for microfilm and machine-readable storage media

- Organizational Structures and Affiliations

  The following states of affairs will be in evidence:

  - Widespread interagency cooperation, standardization, interchange
  - Decentralization of processing and services
  - Increased use of contractors and more cooperative arrangements between government and commercial sectors

- Economics and Marketing

  Highlights of the anticipated future economic situation are as follows:

  - Much lower costs per unit of equipment
  - User-supported funding for government information services
  - Cost savings through reduction of redundancy

- Scope of Services

  Future trends in services are as follows:

  - More sophisticated and more extensive direct user/system interaction
  - Widespread literature analysis service for scientists
  - Improved, faster, document delivery
  - Services in non-bibliographic data storage, retrieval, and analysis

1.3 STRUCTURE OF THE REPORT

The remainder of this report is divided into two sections. Section II covers the methodology of the literature survey, including the subject outline, the sources and the creation of the events list. Section III presents the findings in detail. The complete bibliography and the Events List are included as Appendix A and Appendix B, respectively.

SECTION II. METHODOLOGY

2.1 SUBJECT OUTLINE

The literature search was conducted, following an outline contained in the Interview Guide of the DoD/DDC Interagency Survey. This outline contains the following "target projection areas" for inspection for 1978-1988:

A. Technology

(Computer hardware, data communications, software, document storage and handling, fact storage and handling)

B. Organizational Structures and Affiliations

(Government vs. for-profit and not-for-profit, cooperative arrangements, organizational configurations, management considerations)

C. Economics and Marketing

(Service, R&D and marketing costs, income sources, economic profitability, marketing, competition)

D. Scope of Services

(Subject areas, user groups, nature of services)

The same outline was employed in both the Interagency Survey and Literature Survey in order to ensure compatability of findings and ease of analyzing all data for ultimate interpretation of needs of the defense community in 1978-1988.

2.2 SOURCES

Sources were identified in the following ways

- A thorough search of 1975 (and in some cases 1974) editions of the following abstracting and indexing services
  - Computer and Control Abstracts
  - Computing Reviews
  - Information Science Abstracts
  - Library and Information Science Abstracts
  - New Literature on Automation
  - Quarterly Bibliography of Computers and Data Processing
- A thorough search through AUERBACH holdings, including
  - AUERBACH Publishers, Inc technology reports and forecasts
  - AUERBACH Library catalogs
  - Private collections of staff members
  - Departmental files
- Close liaison with the COTR, who provided additional sources, including a private collection of DDC reports on microfiche

A complete bibliography of all sources consulted (published and unpublished) is contained in Appendix A.

2.3 PREPARATION OF THE EVENTS LIST

The Events List was prepared in a three step process. First, each source was read through carefully. Any information falling within the "target projection areas" (See Section 2.1 above) was recorded on an Events List Data Gathering Form (See Figure 2-1). Approximately 70 forms were used. Next the information (projected "events") on the forms were classified in detail according to the subject outline. This enabled like events to be grouped together.

EVENTS LIST DATA CATEGORIZING FORM

SSC 2326 8/11/75

1. SUBJECT AREA(S) _____

2. EVENT _____

3. CONTINGENCIES & IMPLICATIONS _____

4. PROBLEMS _____

5. COMMENTS _____

6. SOURCE(S) _____

FIGURE 2-1.

Finally the raw events were thoroughly analyzed by the project team. Input from the Interagency Survey was incorporated, and the entire list was condensed and rewritten into 41 projected events in information transfer considered by the project team to most likely affect the defense community in 1978-1984. The final Events List is contained in Appendix B.

SECTION III. FINDINGS

3.1 TECHNOLOGY

3.1.1 Hardware

Computer hardware in the 1976-1988 period is anticipated to include new applications and new capacities:

- Computers will be specifically designed for certain applications, such as bibliographic storage and retrieval
- Computer memories will be larger (while occupying less physical space), faster, and cheaper. Associative memories, laser and magnetic "bubble" memories will be commonly available
- Micro- and minicomputers will be more powerful per unit size, and thus able to take over many functions currently performed by standard size computers. Networks of decentralized minis will replace large centralized computers in information centers
- Optical character recognition and voice input will be competitive with other types of I/O devices, and make conversion of machine readable storage formats easier and cheaper

3.1.3 Data Transmission

Data transmission will be accomplished more easily and economically [illegible] dialup lines, rather than dedicated lines, will accommodate the majority of remote technical information retrieval. Electronic transfer of files between data bases and facsimile transmission will be in extensive use at a cost competitive with the postal service.

3.1.3 Software

Software [illegible] will be more powerful and will accommodate many new applications.

- Software will be powerful enough to provide translations in such areas as user protocols and file structures between different systems and data bases, obviating the necessity for 100% standardization.
- Commercial packaged software will be increasingly customized, but it will move towards machine independence.
- Improved software capabilities will include the common use of such features as automatic monitoring in information retrieval systems, sophisticated automatic indexing of machine-readable text, user choice of output formats, and conversational and tutorial on-line retrieval systems.

3.1.4 Storage Media

Two storage media currently in limited use will emerge as competitive with print.

- Microforms will gain further user acceptance. High-quality, low cost, small size readers and printers will be available.
- Machine readable media will be commonly used for storage and transfer of fact, and numerical data as well as bibliographic data. Word processing, OCR, and inexpensive facsimile transmission will facilitate conversion and use of machine readable storage.

3.2 ORGANIZATIONAL STRUCTURES AND AFFILIATIONS

3.2.1 Interagency Cooperation and Standardization

The current lack of cooperation and standardization (with resulting redundancy and incompatibility) is much discussed in the literature. The following are projected solutions to this lack.

- Federal technical information services will be consolidated into a single organization or a network with centralized control
- Different data bases will be able to be merged and will be accessible through a single type of terminal.
- Standardized formats will be agreed upon for technical abstracts and citations. A single thesaurus will be used for all technical indexing.

3.2.2 Decentralization of Processing and Services

Decentralization of processing will enable distributed input to the large IS&R system, with abstracting, indexing and data conversion provided at the local level.

Decentralization of services will result in local information centers obtaining information products from the larger services and then dispensing them to the users.

3.2.3 Commercial and Contractor Relations

Contractors and commercial sources will be essential to Federal information services. It is forseen that much information processing activities will be delegated to contractor staff, and that software used will be almost entirely commercially supplied rather than developed in house.

3.3 ECONOMICS AND MARKETING

3.3.1 Costs and Income

Some types of equipment, such as microfilm readers and printers and interactive terminals, will have a low enough cost per unit to be affordable by

individual researchers. Computer memory costs, as mentioned in Section 3.1.1 will also go down. As software becomes more powerful and specialized, however, it is likely to increase in price.

Problems of financial support for Federal technical information processing and dissemination activities will be resolved since it seems likely that the Federal mandate handed down to NTIS and GPO will spread to other agencies. Some sources however, feel that all government and some other type of information centers will be deemed eligible for partial or full government subsidy by the 1980's.

3.3.2 Cost Savings

Cooperation and standardization activities have been discussed in Section 3.2.1. A logical result of these activities is a sizeable reduction in funds and effort previously expended in processing and retrieving redundant information. The availability of machine-independent software (discussed in Section 3.1.3) will also result in cost savings.

3.4 SCOPE OF SERVICES

3.4.1 User-Information System Interaction

User-researchers will be able to interact with information systems directly and, in so doing access a larger group of sources than they can collectively.

- Software design will be adequately sophisticated to permit a novice requester to use an on-line terminal through a set of tutorial programs.
- A number of data bases may be accessed by a researcher through an inexpensive personal terminal on his desk
- Through this terminal, a researcher will have access to a large multidisciplinary bibliographic data base. Then paper abstracting and indexing journals will be largely unnecessary.
- The researcher will be allowed a choice of output from the interactive system: hard copy, microfilm, CRT viewing, with a choice of formats.

3.4.2 Information Analysis

By the 1980's, R&D personnel will be able to request detailed analysis and synthesis of data in their fields of interest.

3.4.3 Document Delivery and Dissemination

Document delivery will be faster, cheaper, and more automatic in the 1980's.

- Facsimile transmission will go down in price, but increase in speed
- With increased speed and lower price of document delivery, it may prove more economical to distribute full texts automatically than to provide abstracts or announcement services.

3.4.4 Processing of Non-Bibliographic Data

Storage, retrieval, and analysis of bibliographic data will assume a lesser importance. Other types of data will assume prominance:

- Access to numeric data and analysis of numeric data will be provided to researchers who previously had to access such data through bibliographic references
- Management information data and data analysis will become much more useful and sophisticated

APPENDIX A.

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APPENDIX B.

EVENTS LIST

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1. Duplication among major bibliographic data bases will be virtually eliminated through inter-organizational agreements.

2. Input of information to large IS&R systems (e.g., DDC, NTIS, NASA, etc.) will be decentralized, with abstracting, indexing, and data conversion provided at the local source level.

3. Computers designed specifically for bibliographic storage and retrieval applications will be available.

4. Machine-readable storage media will be competitive from cost, capability, and access time standpoints with:

   (a) Paper
   (b) Microform

5. Associative memories will be commonly available for use in machine aided

   (a) Retrieval
   (b) Information Analysis

6. 85% of remote technical information retrieval will be accomplished via dial-up (public switched) communications lines. The remainder will be accomplished through dedicated lines.

7. Files, (of the size equivalent to a reel of magnetic tape) will be electronically transferred directly from one data base to another at a transmission cost which is competitive with mailing a reel of tape.

8. Processing in large scientific information systems will be performed by a network of decentralized minicomputers rather than by large, centralized computers.

9. It will be possible for a user organization to readily merge available scientific and technical bibliographic data bases into a single file.

10. Through ready access to central information storage and dissemination facilities, users can bypass local information or library facilities and these can be eliminated.

11. Using a single terminal each R&D professional will be able to query any bibliographic or numeric data base of his choice.

12. Each R&D professional will be able to purchase an interactive computer terminal for less than $500.

13. Increased computer capacities and reduced processing costs will allow each R&D professional to have his own on-line interactive terminal.

14. A high-quality, low cost (i.e., under $100 microfilm reader-printer will be commercially available.

15. Microforms will become equal to paper in acceptability by information users.

16. Facsimile transmission will be competitive with postal service for full text document delivery in terms of cost and speed.

17. Paper will be replaced as the primary document dissemination and storage medium by:

    (a) Microforms
    (b) Full text digital media
    (c) Sound recordings
    (d) Other (specify)

18. Machine-readable R&D data bases will be electronically linked so that a user of any one of these data bases can, with proper authorization, directly access any other data base through an on-line terminal.

19. Automatic retrieval systems will have built-in monitoring features, thus providing instant analysis of system use and user needs.

20. Paper will be replaced as the primary numeric data storage and dissemination medium by:

    (a) Microforms
    (b) Digital media
    (c) Sound recordings
    (d) Other (specify)

21. A single standard, interdisciplinary subject indexing vocabulary adopted for use by all the major science information services.

22. Common, standardized citation formats for all technical report literature will be adopted by all scientific and technical information services.

23. Common, standardized abstract formats for all technical report literature will be adopted by all scientific and technical information services.

24. For scientific and technical report literature, the generation of acceptable index data from machine-readable text will virtually eliminate the need for manual indexing.

25. Optical character recognition devices will readily convert any document to machine-readable form, regardless of format or type font.

26. Increased use of word processing equipment will make machine-readable versions of full text documents readily available.

27. Use of commercially available software packages for document storage and retrieval applications will virtually replace original software development.

28. All package software will be machine independent.

29. Standardized user protocols for on-line interactive retrieval systems will be adopted by all technical information services.

30. Conversational and tutorial on-line retrieval systems will evolve to the point where human intermediaries between the system and the requester become unnecessary.

31. In an R&D environment, interactive on-line access to bibliographic data bases will virtually (i.e., 90% +) replace the traditional abstracting and indexing journal in paper form as a literature searching tool.

32. Low cost, rapid dissemination of full text of documents will preclude the need for abstracts as document announcement and retrieval devices.

33. Automatic delivery (as opposed to delivery upon demand) of information products such as documents and citations, will become the rule, request services will become the exception.

34. All machine-based information systems will permit the user to specify his own output format, with virtually no limitations on data order or structure.

35. Two levels of information providers will emerge and be clearly definable: those large information services which wholesale their products to local libraries and service centers, and local activities which "retail" their products directly to end users.

36. All R&D personnel will have the option of requesting detailed analysis and synthesis of the literature of their discipline through an established service, such as an information analysis center.

37. In the R&D environment, the collection, storage, and retrieval of numeric data will at least equal, if not surpass, in volume and importance, the processing of bibliographic information.

38 R&D scientists will have access to discipline oriented data bases of highly select, certified and validated numerical data as opposed to bibliographic references to reported results and data bases of unverified data.

39. Federal technical information processing and dissemination activities will become virtually self-supporting.

40 Virtually all Federal technical information services will be merged into a central organization.

41. Federal agencies will employ contractor staff to perform virtually all of their information processing activities.